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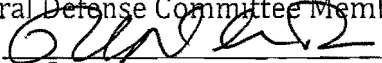
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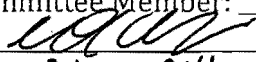
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Executive Summary

Title: The New Theater ISR Paradigm

Author: Maj Max Pearson

Thesis: The DOD continues to understand both its ISR apparatus and our adversary as linear systems based on Cold War threats and technology. The nature of both has changed, but the ISR paradigm has not. In reality, each operates as complex adaptive systems. The DOD needs a new theater ISR paradigm that capitalizes on the non-linear characteristics of DOD ISR in order to counter those of our enemy.

Discussion: ISR encompasses a remarkably large group of people and machines, and it continues to grow. Elements within ISR are becoming increasingly interdependent as analysts gain greater access to data from more sensors looking at similar targets. Consequently, the actions of each collector and each analyst impact others more and more, especially at the theater level where multiple dissimilar assets often focus on the same target. Simply put, DOD ISR has become a network. This makes a common understanding of the interactions within this network all the more important. Without it, the DOD seriously risks jeopardizing synergistic effects within its intelligence apparatus. It is time to be explicit about how we think about ISR.

Doctrine defines neither *an* ISR paradigm, nor *the current* ISR paradigm. Regardless, the DOD is in need of both. This paper defines an ISR paradigm as this: *the understanding of the interactions amongst people and machines within DOD ISR and national intelligence agencies that shape how doctrine, processes, and the structure of forces are optimized in order to counter the perceived adversary.* Although formally undefined, the current theater ISR paradigm can be inferred from doctrine and processes. It is sorely out of date, and must be replaced.

Conclusion: Under the current paradigm, the ISR network and the adversary it is tasked to counter are seen as linear systems. Doctrine and critical processes that span the entire intelligence cycle remain optimized for the Soviet threat. As a result, the ISR network is optimized, maybe managed. It is not led. The DOD needs a new theater ISR paradigm that recognizes the complex adaptive nature of its theater ISR network. The paradigm must capitalize on the non-linear characteristics of DOD ISR in order to counter those of our enemy. To do so, it must harmonize the efforts and initiative of its various organizations, personalities, and cultures around a common goal. Mission type orders provide a vehicle to define this common goal. This new paradigm could not be more important to our success in today's fight, or our preparation for tomorrow.

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Preface

Like many in my profession, I have been concerned about improving processes within DOD theater ISR for some time. Over time, I recognized that many of the problems I hoped to address were related to one another. They stemmed from an understanding of how theater ISR works as whole, and an overall understanding of how our adversary operates. In order to discuss how an understanding affects operations, I chose to introduce and define the concept of an ISR paradigm. This definition and discussion may seem theoretical to some. However, hours of discussion with ISR professionals in various roles leaves me convinced that this connection between an understanding, and its impact on operations, is both legitimate and critical.

My understanding of DOD ISR has been shaped by instruction I have received from subordinate and superior alike, and I am sincerely grateful to those who have taken the time to help make me a better ISR professional. I would also like to thank Dr. Paul Gelpi, without whose patience and persistence I would never have organized these thoughts coherently. Finally, I extend my utmost gratitude and love to my wife and daughter. They have suffered more over this paper than any thorough reader ever will.

INTRODUCTION

The DOD's *Dictionary of Military and Associated Terms* defines Intelligence, Surveillance, and Reconnaissance (ISR) as "An activity that synchronizes and integrates the planning and operation of sensors, assets, and processing, exploitation, and dissemination systems in direct support of current and future operations."¹ ISR encompasses a remarkably large group of people and machines, and it continues to grow. Elements within ISR are becoming increasingly interdependent as analysts gain greater access to data from more sensors looking at similar targets. Consequently, the actions of each collector and each analyst impact others more and more, especially at the theater level where multiple dissimilar assets often focus on the same target. Simply put, DOD ISR has become a network. This makes a common understanding of the interactions within this network all the more important. Without it, the DOD seriously risks jeopardizing synergistic effects within its intelligence apparatus. It is time to be explicit about how we think about ISR.

Doctrine defines neither *an* ISR paradigm, nor *the current* ISR paradigm. Regardless, the DOD is in need of both. This paper defines an ISR paradigm as this: *the understanding of the interactions amongst people and machines within DOD ISR and national intelligence agencies that shape how doctrine, processes, and the structure of forces are optimized in order to counter the perceived adversary*. Although formally undefined, the current theater ISR paradigm may be inferred from doctrine and processes. It is sorely out of date, and must be replaced. Based on Cold War threats and technology, it continues to envision both DOD ISR and our adversary as linear systems.² The nature of both has changed, but the paradigm has not. The intelligence community collaborates today in ways unimaginable twenty-five years ago, and the modern foe does not operate in a structured and predictable way as the Soviets did. Both operate as complex

adaptive systems. The DOD needs a new theater ISR paradigm that capitalizes on non-linear characteristics of the DOD ISR network in order to counter those of our enemy. This paper will characterize the current paradigm, explain why it must be replaced, and ultimately propose a new theater ISR paradigm.

CURRENT PARADIGM

The current paradigm is not defined in Joint doctrine, and must be drawn from examination of DOD doctrine, processes, and structure of forces. The paradigm is not easily defined, and it is often obscured by the complexity of DOD ISR as a whole. To shed light on this current understanding of interactions, this section will examine critical elements across the intelligence cycle,³ starting with analytical process that identifies collection requirements. It will then follow these requirements through the collection management process as they make their way to collectors. Lastly, it will consider the fusion that happens as requirements are satisfied and as analysts make sense out of subsequent reporting.

The foundational analytical process defined in both Army and Marine Corps doctrine presumes an adversary will react in a repetitive, predictable fashion. This process is called Intelligence Preparation of the Battlespace (IPB), and it initiates the collection cycle by determining how to collect on the enemy. Early in IPB, analysts develop an adversary template based on adversary weapons system capabilities, as well as how the adversary moved and arrayed forces in the past.⁴ With this data, analysts create a graphical representation of the adversary's "nominal organization, frontages, depths, boundaries, and control measures."⁵ Next, analysts build a terrain model that highlights obstacles, natural mobility corridors, and major avenues of approach. They then overlay the adversary template on the terrain model to identify

which actions the adversary will take. The goal of this process is to identify how the adversary will react to the terrain, and which avenues of approach they will use. From this process, analysts identify collection requirements to confirm their assessed adversary movements and to trigger friendly commander reaction. Starting with the initial analysis that generates collection requirements, the current doctrinal process assumes an adversary will operate predictably.

Once the IPB process has identified collection requirements, these requirements enter a Joint collection management process designed around rigid, bureaucratic interactions. In general, this process involves compiling requirements from analysts and tasking them to collectors. Specifically, collection managers review and validate requirements, prioritize them based on commander's guidance, and finally select the most appropriate collector to satisfy each requirement based on a multitude of factors.⁶ In order to ensure efficiency in a process that manages thousands of requirements, Joint doctrine separates the analysts who submit the requirements from the collectors who satisfy them by many bureaucratic layers. Specifically, Joint Publication 2-1, *Joint and National Intelligence Support to Military Operations*, separates the authority to determine which requirements should be collected (Collection Requirements Management) from the authority to choose which sensors will collect them (Collection Operations Management).⁷ Accordingly, once a requirement is prioritized and approved for collection by the Requirements Management, it is passed to the Operations Management for tasking to an individual collector. These two authorities are granted to different entities, and this creates the need for extensive coordination throughout multiple organizations.

The bureaucratic collection management process is optimized for scenarios that do not require dynamic interaction. If either the collector, or the analyst who submitted the requirement, needs to make a significant change such as adding additional targets or changing

the location of the targets, both the Requirements Management and the Operations Management must approve it. This reflects an understanding of ISR operations in which neither the battlefield, nor the collection requirement, changes between the time the requirement is submitted and the collection occurs. Furthermore, this understanding presumes that collectors satisfy all requirements like clockwork, with no need for interaction with the analysts.

After collection, fusion efforts are inefficiently consolidated based on an understanding of technology that is decades old. Large reach-back ISR centers are tasked with a narrow role of reporting on specific collection targets, and not with producing fused intelligence products. The databases that manage collection requirements contain specific, limited fields for data entry. Based on their design, these databases manage simple requests for collection and interpretation of collection results. They do not manage requests for fusion. As a result, the majority of collection tasking is sent from small in-country teams to large reach-back ISR centers in the form of very specific collection requirements. Therefore, small teams of analysts in Afghanistan and Iraq ask huge reach-back ISR centers to perform very narrow collection roles. These teams then take the reporting from reach-back ISR centers and try to fuse it with reporting of other sensors and sources themselves. The collectors at reach-back ISR centers are thus naturally excluded from the fusion process. This concentration of fusion efforts in small teams is not intentional, but rather the natural byproduct of an outdated paradigm.

The goal of this paper is not to critique specific processes, but to examine them in order to identify how our understanding of the ISR network and our adversary impacts these processes. Were it articulated, the current theater ISR paradigm would describe a structured system of interactions within DOD elements. It would also describe an adversary that is largely predictable. Although there are many other processes within DOD ISR that this paper leaves

unexamined, those that it has considered are foundational to the ISR cycle. They provide enough fidelity regarding the current paradigm to compare with the current environment.

CURRENT PARADIGM VERSUS CURRENT ENVIRONMENT

The current paradigm originated during the Cold War, and it was appropriate for that era. The Soviet military apparatus functioned like the adversary envisioned in that paradigm in many ways. Their military forces were arrayed similarly in many different locations, and overall they acted predictably. Over the years, DOD analysts build a reliable adversary template based on predictable interactions between the various elements of the Soviet forces. If the Soviets forward deployed strategic bombers to certain bases, analysts could reasonably determine if they were preparing to attack NATO countries by looking at other elements of their military forces. If their ground forces showed no signs of attack preparations, and if their naval forces had not changed their readiness posture, analysts could safely assume the aircraft deployment was not indicative of an imminent attack because it did not fit the template for a Soviet attack. By and large, the Soviets followed this adversary template.

However, the current adversary does not fit this paradigm. They function as a thinking, interacting, and learning organization. Forensic psychiatrist and government counterterrorism consultant Marc Sageman uses social network analysis to describe al Qaida.⁸ He describes how key facilitators act as important nodes, connecting geographically separated clusters of extremists around the world. This social network does not function like a structured Soviet force. Individuals within the network do not react consistently, and their interactions with others are far from predictable.⁹ Furthermore, as opposed to the more structured organization that conducted the attacks on 9/11, today Islamic terror networks are evolving into unpredictable,

fluid entities.¹⁰ In order to counter this adversary, the DOD needs a flexible, dynamic collection management process in order to adapt and keep up with adversary moves. The current paradigm does not match this adversary, and it does not match the current DOD ISR network.

The rigid, bureaucratic collection management procedures in current Joint doctrine matched the technology and security restrictions of the DOD ISR during the Cold War as well. Long before web pages and online databases, classified information was sent point-to-point over special communication circuits. Security regulations limited those who could receive intelligence reports to a predefined, static distribution list of organizations. As a result, there was less demand for last-minute changes to collection plans because analysts had less info to work with. This was not problematic because the lack of dynamic combat operations with the Soviets left time for bureaucratic coordination to establish and adjust collection plans.

Today, the DOD ISR network looks much different. Intelligence reports are often posted to databases that are widely accessible due to technology and post-9/11 intelligence sharing procedures. Analysts share large high-resolution imagery files, presentation slides, and large text files across multiple intelligence centers on multiple continents simultaneously. Furthermore, collaborative tools such as chat and Facebook-like applications enable simultaneous exchanges between analysts, collectors, and collection managers. As a result, dynamic interactions about collection management no longer happen in a linear, sequential fashion, but rather as quick, collaborative chat room discussions. Overall, the DOD ISR network of today does not match the understandings of interactions that define the current theater ISR paradigm.

THE NEED FOR CHANGE

Neither today's adversary, nor the DOD ISR apparatus, matches the current paradigm. The following section will demonstrate the need for a new theater ISR paradigm by exploring the implications of the mismatch, and by detailing what ISR professionals are doing to satisfy the mission despite these implications.

Problems Within the Intelligence Cycle

The current IPB process presumes a predictability that limits the effectiveness of intelligence analysis overall. It creates an analytical mindset that drives collection efforts focused on previously activity and previously identified targets. It does not encourage analysts to actively look for new, unexpected developments, even when the ISR system has the capacity to do so. For example, the US intelligence community was surprised by the revelation of a new North Korean nuclear facility in October of 2010.¹¹ Imagery analysts spent much more time looking at up-to-date imagery of the known facility, Yongbyon, than they did combing over imagery in search of new facilities or new construction at unexpected locations. They expected the North Koreans to operate like they always had.

Furthermore, the rigid collection management process hinders effectiveness by giving individuals the option to forego important collaboration by relying on doctrinal procedures. According to our current paradigm, an analyst who inputs a collection requirement into the system will get the subsequent reporting back in a mechanical fashion, without need for modification or interaction with others involved in satisfying the requirement. To understand how this works, consider a hypothetical example from Afghanistan. An Army analyst in Regional Command East sends his collection requirement up the chain of command to the CCJ2

staff at NATO's Integrated Joint Command (IJC), who serves as the Collection Requirements Manager. IJC's collection manager prioritizes this requirement against those received from the other Regional Commands. IJC then forwards it to the Collection Operations Manager at the Air and Space Operations Center (AOC). The AOC tasks it to a specific collection platform, or sensor. That collection platform collects exactly what the Army analyst asked for, and subsequent reporting provides the answer that the Army analyst expected, with no interaction between analyst and collector required.

In reality, every person in the ISR system represents a thinking individual who acts and interacts with others based on personality, mood, previous experience, and a slew of other factors. These people involved in DOD ISR are dynamic, and they have unintentional affects on all processes in the intelligence cycle. Using the previous example, consider the following plausible scenario. When the AOC Collection Operations Manager receives the collection requirement from the Army analyst, he realizes that it is the same requirement he has received daily for the past ten days. The U-2 liaison officer complained about receiving the same targets day after day, so he decides to task it to a Global Hawk mission instead of the U-2 that has collected that target for the past ten days. According to doctrine, he chooses the most appropriate sensor, and is not obligated to talk to the analyst who submitted the requirement before he tasks it for collection. Therefore, unless he goes above and beyond doctrinal procedures, he doesn't know that the Army analyst looking at that target has built a rapport with the Distributed Ground Station (subsequently referred to as DGS), the large reach-back ISR center that controls the U-2 sensor and has exploited imagery of the target for days. As a result, the Global Hawk sensor planner collects the image from an angle optimized for his sensor. Subsequent imagery and analysis does not satisfy the Army analyst's requirement. Despite well-

intentioned personnel who adhere to doctrine, ISR effectiveness is diminished due to a simple lack of interaction that is not required within the current paradigm.

Additionally, the bureaucratic coordination required between Collection Requirements and Collection Operations Management authorities has detrimental effects on the ISR network in dynamic situations. Assume the Army analyst has intelligence indicating a high-level insurgent is going to meet his associates in two days. His sources indicate the specific village where the meeting will happen, and he requests collection in order to search the entire village for signs of it. After studying the village, the Army analyst requests 10 high-resolution images to cover all possible buildings. The IJC Collection Requirements Manager supports the request and forwards to the AOC Collection Operations Manager, who tasks a U-2 to collect the images. Based on other intelligence they collected, the DGS controlling the U-2 sensors determine the meeting is happening in a different village that is 5 kilometers away. They contact the Army analyst on chat, who asks the DGS controlling the U-2 sensor to change the collection plan to look at the correct village. According to procedures in current Joint doctrine, a collection platform like the DGS & U-2 cannot drop the 10 pre-planned targets, or add another 10 targets for the new village, without getting approval of the AOC Collection Operations Manager. The AOC, according to doctrine, cannot make significant changes to the prioritization of collection requirements without the approval of the Collection Requirements Manager. So if operating according to doctrine, the ISR system could take anywhere from minutes to hours to approve the logical change to the collection plan. In this example, the mismatch between the current theater ISR paradigm and reality significantly hinders the responsiveness of ISR in dynamic situations.

The exclusion of collectors from the fusion process is also very limiting given the significant resources and capacity they represent within DOD ISR. Often the analysts submitting

requirements are part of small teams in Afghanistan or Iraq, and the collectors are part of large reach-back ISR organizations. In addition to having many more analysts, these reach-back ISR centers are typically equipped with much more modern equipment and technology than the small fusion centers in country. Regarding expertise, reach-back centers are manned with both all-source analysts, as well as personnel who have had technical training on how to interpret raw collection data from many different sensors. This diversity of skill sets and equipment offers a broader analytical base than what the small in-country teams can muster based on their manning and logistical challenges. However, despite all that the DOD has invested in reach-back ISR, the current paradigm does not optimize their contributions due to an antiquated understanding of technology and interactions within the ISR network.

Mid-grade ISR Professionals Operating Outside the Paradigm

In light of the problems created within the ISR cycle by the mismatch between the current theater ISR paradigm and reality, mid-grade ISR professionals have recently taken the initiative to work outside the confines of current doctrine to accomplish their mission successfully. Although the Air Force Theater ISR CONOPS was largely unnoticed upon its release in 2008, it has provided alternatives for the traditional approaches shaped by the current paradigm. Of all the concepts that the Theater ISR CONOPS calls for, the idea of ISR tasking in the form of a mission type order (MTO) has gained the most traction. The concept of an MTO dates to 19th century Prussian military theory, but it represents a significant departure from the current paradigm.¹² Applied to ISR, the principal tenants are that ISR tasking should clearly define purpose and intent of higher headquarters, and grant the leeway for collectors at the lowest level to exercise initiative in order to achieve that intent.¹³ This initiative should be

driven by a multitude of factors such as the realities of the battlefield and enemy, the sensor capabilities, and collaboration with the analyst who submitted a requirement. This is a sharp contrast from the collection management system defined in Joint doctrine, whereby a specific collection target provides little context, and no flexibility, to the collectors who execute the tasking.

ISR personnel first used MTOs to task ISR assets in Korea in late 2008. During this time, the 7th Air Force AOC, acting as the Collection Operations Manager, tasked their DGS with U-2 collection that included both traditional targets as well as MTOs. Their tasking gave the DGS the authority to drop preplanned collection targets in order to collect against certain types of emerging target activity. The AOC defined which target activity would warrant dropped targets, and the DGS took the initiative only when they observed activity that met the conditions defined in the MTOs. This enabled DGS-3 to quickly respond to changes in the battlefield, and in many cases facilitated time-sensitive collection that drove national-level decision-making. This represented a major break from the traditional paradigm. Effectively the Collection Operations Manager authorized individual collectors to drop targets, i.e. to reprioritize collection requirements, without consulting the Collection Requirements Manager. As a new technique, this MTO tasking represented a break from the current paradigm. This was just the start.

During the final stages of planning for the NATO offensive in Afghanistan's Helmand Valley in February of 2010, collection managers at multiple levels decided to use MTOs to increase the responsiveness of ISR in support of ground operations. Applying the concept fully, the ground forces drafted MTOs that included their purpose and intent, Collection Requirements Managers at IJC supported the idea, and the AOC issued MTOs to all U-2 and Global Hawk missions. For a period of over two weeks, the AOC did not provide a single collection target to

U-2 or Global Hawk planners. Instead, they provided the purpose and intent of the overall mission, and DGS planners worked directly with ground force analysts in Afghanistan to develop the collection plan for both platforms. In many cases, in-country analysts collaborated with collectors controlling sensors at reach-back ISR centers to change collection plans just minutes before collection in order to respond to developments on the battlefield. As a result of the success of this MTO employment, DOD elements continue to use MTOs to task certain ISR missions in the CENTCOM AOR nearly one year after this initial trial.¹⁴

The problems created within the ISR cycle by the current paradigm, coupled with mid-grade ISR professionals operating outside the paradigm, clearly point to the need for change. However, in order to address the root cause of the problem, the change must not simply address specific processes within the ISR cycle. Change must address the paradigm. Change must start with how the DOD understands the interactions within ISR.

A BETTER WAY TO UNDERSTAND INTERACTIONS

To craft a new paradigm, this paper will focus on interactions. As previously stated, these interactions occur amongst people and machines. Scientific study offers two domains that prove particularly useful when analyzing such complex collections of elements: systems theory, and a subset called network theory. These domains provide insights that prove very valuable in an effort to understand the interactions within DOD ISR. Their models lay the groundwork for a new paradigm. The following section will briefly explain both systems and network theories, following each description with an explanation of how the models of each theory apply to DOD ISR.

Systems Theory

Systems thinking, and systems theory, make up a very useful intellectual arena that has been applied to systems similar to ISR. The Joint Dictionary of Military Terms defines a system as a “functionally, physically, and/or behaviorally related group of regularly interacting or interdependent elements; that group of elements forming a unified whole.”¹⁵ The most dynamic interactions within DOD ISR occur between people, and systems theory has much to offer in this domain. Peter Senge, an often-read pioneer in this field, advocates for examining human interactions in the context of a system. He cautions, “we tend to focus on snapshots of isolated parts of the system, and wonder why our deepest problems never seem to get solved.”¹⁶ Accordingly, to best understand ISR, we will first consider it as a system.

Researchers have developed many different models to explain the interactions within systems, and distinctions between the models are key to their relevance. Two useful models are that of a linear system, and that of a complex adaptive system. A linear system is one that is very predictable, like a machine, in which the parts of the system interact with each other consistently over time. The individual parts have no freedom to change their behavior, and subsequently the overall system’s behavior is consistent. An input made on a linear system will produce the same output every time. A car is great example; every time you step on the gas pedal, the car accelerates.

A complex adaptive system is quite different. It is complex because it is made up of dynamic elements that forge dynamic relationships with each other, not by static parts that interact consistently time and again. It is adaptive in that the behavior of both the individual element and the overall system changes based on past experience and lessons learned.¹⁷ An example of a complex adaptive system is the stock market; individual brokers change their

behavior and the associations with each other over time, and they surely change their buying and selling practices based on experience and market research.

In many ways, the mismatch between the current paradigm and reality can be explained using these two models. The predictability of the IPB process represents an assumption that the adversary operates as a linear system. The adversary template for the Soviet forces showed a forward deployment of aircraft alone did not equate to a pending attack. Also, the bureaucratic inflexibility of the collection management process represents an understanding of DOD ISR as a linear system in which collectors, analysts, and collection managers all interact with each other in a very rigid manner. An input to the system (collection requirement) generates the same output (satisfied requirement and satisfied analyst) every time, and interactions between the analysts and the collectors are mechanical. In reality, the complex adaptive system model is much more appropriate. Al Qaida has clearly learned from our offensive operations and is becoming less and less predictable.¹⁸ They are changing the way they interact with their multiple cells worldwide, and they are adapting based on observation. Within DOD ISR, interactions are complex and adaptive. Analysts find new colleagues to work with based on their collection targets and the value of the products these colleagues deliver. DOD ISR simply does not operate as a linear system. The new paradigm must be built on an understanding of both the adversary, and DOD ISR, as complex adaptive systems. It must capitalize on the nature of interactions within DOD ISR to best thwart those of our adversary.

Network Theory

In addition to systems theory, network theory offers insights into the world of DOD ISR. Researchers define many types of networks based on their different characteristics. However,

considering how information spreads across networks, researchers define only two distinct methods. In a conserved spread network, the quantity of information that enters a network remains constant at any given time. In such a network, information can only be in one place at any given time. A classic example is that of a pitcher of water poured into series of pipes and joints; once the water passes through one pipe, that pipe empties while others in the network are filled with water as it passes by. On the other hand, in the case of a non-conserved spread network, the amount of information changes as it flows through a network. Multiple nodes can share specific information at the same time. The same network of pipes and joints connected to a continuously flowing faucet represents an example; the pipes are always filled with an endless supply of water.

A more representative analogy is that of a newspaper newsroom. Before the advent of copy machines and computers, reporters typed their draft story and actually handed the physical copy to an editor for review. The editor read the story, and then passed the physical copy to the print room to go to press. These newsrooms represented conserved spread networks. However, now that they have added modern computer equipment, they have transitioned to non-conserved spread networks. Once a reporter drafts a story, editors and other reporters read it simultaneously throughout the establishment.

The current ISR tasking databases, and resulting exclusion of collectors from the fusion process, reflects understanding of DOD ISR as a conserved spread network in which intelligence flows in a point-to-point fashion and can only be consumed by one analyst at a time. Modern technology and post-9/11 policy has lead to incredible intelligence sharing, enabling analysts located virtually anywhere around the globe to consume reports and focus on targets in any country. Assessments and products can be simultaneously accessed by in-country teams as well

as reach-back ISR centers. The new theater ISR paradigm must be built on an understanding of ISR as a non-conserved spread network.

NEW THEATER ISR PARADIGM

This paper defines an ISR paradigm as an understanding of interactions that shape doctrine, processes, and the structure of forces. In order to propose a new paradigm for theater ISR, this section will take a practical approach. It will provide recommendations for both an understanding of ISR, and recommendations for the manifestation of that understanding in doctrine, processes, and structure. A complete paradigm shift is a long way away, and will require numerous updates to doctrine, operating procedures, training, etc. Nevertheless, the following recommendations will have an immediate impact on how the DOD understands ISR, as well as how that understanding impacts the effectiveness of ISR in the current fight.

Foundational Understanding

The DOD needs to publish a short, accessible document in simple language that defines a common understanding of ISR. There is strong precedence of military services publishing manuals to introduce fundamental new concepts. The Army published a revised Field Manual 100-5 in 1982, driving a shift from the paradigm of Active Defense to one of AirLand Battle.¹⁹ Additionally, the Marine Corps published Fleet Marine Force Manual 1, *Warfighting*, in 1989, to establish maneuver warfare as their dominant paradigm.²⁰ The DOD must publish a similar manual that is short and simple enough to be accessible to the masses, yet conceptual enough to establish a way of thinking about the interactions that make up ISR. Like *Warfighting*, it should be descriptive, not prescriptive. It must tell ISR professionals how to think about ISR, not what

to think. The topics below serve as both a foundation of this understanding, and an example of what this document should cover. This is meant to be an abbreviated illustration, and should not be considered all-inclusive:

ISR IS A NETWORK. No individual person or organization operates alone. Their actions are part of a greater network that comprises everyone involved, from the analyst to the collector, from the communications professional to the collection manager. These actors are inter-dependent, and the actions of each one of them affect the others more and more. The ISR network also involves the equipment and technology used, ranging from sensors to databases, from individual workstations to collaborative tools. This has enormous implications for ISR professionals. First and foremost, it means they must strive to understand how their actions affect others within the ISR system. This is crucial to professionalism. Our greatest assets are our professionals who develop a solid understanding of how they and their organization fit into the greater ISR system. Second, it means they must understand how the equipment and technology impacts the operation of the system as a whole.

THE ISR NETWORK MUST BE LED. The operations of the ISR network must be led. The synergistic effects created by unity of effort can only be created by a network that is not managed or optimized, but by a network that is led. Mission type orders serve as the harmonizing agent to do optimize the network. MTOs define the purpose and intent of ISR operators, enabling initiative throughout the ISR network to drive dynamic responses to changes in the battlefield based on the common goals. ISR professionals need to understand this purpose and intent. They must understand how they fit into the fight.

ISR IS ABOUT THE PEOPLE. Given the technical nature of our sensors, databases, and tools, many personnel have become mesmerized with technology. They see it as the driving

force behind ISR. This perception could not be farther from the truth. People make up the foundation of our ISR system. The interaction between the analysts, collectors, and personnel who use ISR products is the backbone of success. Without these interactions, no amount of technology, machines, or sensors will ever produce the results that collaborative ISR generates.

ISR IS CHAOTIC BY NATURE, AND PROFESSIONALS MUST THRIVE IN UNCERTAINTY. ISR professionals must strive to sift through the chaos and wealth of data available to find the key information they need. It will not be magically sent to them by some computer system or database that recognizes the nature of their problem. Furthermore, like weather forecasting, even an infinite set of data points will not answer some of the questions posed to ISR professionals. There will always be surprises. ISR professionals must be prepared to get it wrong sometimes despite enormous efforts.

ISR IS COLLABORATIVE. DOD ISR is made up of many dynamic elements (people) that forge dynamic relationships with each other, not by static parts that interact consistently time and again. This means that while trust and relationships are a critical element, ISR professionals cannot be static in their interactions. They must constantly seek out new people and new organizations to help them accomplish their mission. ISR is collaborative in every step of the ISR cycle.

BEING IN THE FIGHT IS A STATE OF MIND, NOT A STATE OF GEOGRAPHY. Modern technology has made the battlefield accessible to ISR professions across the globe. This access makes reach-back ISR a critical part of our operations in distant conflicts. The men and women downrange depend on reach-back ISR operators with their lives. ISR professionals must put aside their personal lives and commit their entire mental capacity to the fight when at work.

This requires significant mental agility. They must maintain focus on the fight far away while living their day-to-day lives in the comfort of a peaceful society.

EFFECTIVENESS IS MORE IMPORTANT THAN EFFICIENCY. The erroneous understanding of DOD ISR as a machine-like system has driven many to assess its merits as they would mechanical systems. The quality of DOD ISR shall not be judged by how well management has engineered efficiency into operations, but rather by how effective our system is in satisfying the intent of its tasking and defining the environment it is monitoring. Metrics have their utility, but must not be the foundation upon which the ISR system is measured.

OUR ADVERSARIES OPERATE AS A NON-LINEAR SYSTEM. Intelligence analysts cannot expect our adversaries to act consistently over time, and they cannot be lazy in their quest to assess future adversary moves. Although analysts may focus significant effort on monitoring current adversary disposition, they must also strive to understand how the adversary will adapt and evolve. This means trying to understand how the adversary thinks, considering their options, and taking risks to assess their future moves. At times, analysts will expend collection efforts on fruitless attempts to do so.

Mission Type Order Tasking

The DOD must adopt the MTO model as the norm for ISR tasking. It will reap the benefits of MTO tasking in many domains. First, MTOs will revolutionize how ISR planning is accomplished and will lead to greater integration with maneuver operations. For ISR planners working as part of Operational Planning Teams in places like Afghanistan, speaking of potential ISR tasking in terms of MTOs will be much more useful than talking about specific targets. They will give ISR planners a mechanism to discuss broad ISR efforts with authority, without

worrying about the specific collection targets. Furthermore, MTO employment will provide the same context, purpose, and intent of the requirements to ISR planners at all levels, enabling them to make more educated decisions about prioritization than those based on the database entries of today. By broadening the discussion from specific targets to MTOs, ISR planners at lower echelons will secure approval of support from higher headquarters quicker, and will thus be much more effective in integrating ISR into overall planning.

Additionally, MTO tasking will enable collaboration between the analyst and collector, thereby fueling initiative amongst the people who understand the targets and requirements best. Properly written ISR MTOs will provide the purpose and intent of operations. They may even define boundaries of behavior within which collectors can operate freely in order to satisfy the intent of tasking. This will facilitate lower-level initiative by empowering collectors to work regularly with analysts to optimize the collection plan during mission planning and execution. The consistent interaction between analysts and collectors will help ensure decisions are made based the most up to date understanding of the battlefield.

Furthermore, MTO tasking will help distribute the ISR workload to organizations and places where the DOD is well postured to conduct fusion. It will expand the role of the reach-back ISR centers beyond simple collection and reporting. For example, the 40 to 60-person teams of imagery, signals, and all-source analysts working at AF DCGS sites will be asked to do more than simply describe what is distinguishable on current imagery. They will be given holistic ISR missions to accomplish in support of maneuver units, and will integrate with them during planning and execution. They will recognize how they fit into their overall operation.

As a result, MTOs will greatly expand the number of ISR professionals who are fully committed to our current fight. Today, soldiers and Marines in maneuver units all read their

commanders' purpose and end state for their operations. They know their mission statement, and discuss definitions of their subsequent tactical tasks. On the other hand, the ISR personnel supporting these missions have little to no idea of such tasks or exactly what they mean, let alone the purpose and intent of the operation. They are isolated by thousands of miles in a reach-back architecture governed by linear thinking. In the new paradigm, ISR professionals will read the same mission statements as the maneuver units they are working with. Collaboration will drive first-hand imagery and signals collectors, as well as the all-source analysts they work with, to understand the scheme of maneuver of the friendly forces in the fight.

To start, the DOD must commit to studying the lessons learned from recent experience. The success of mission type orders as an ISR tasking mechanism in CENTOM was naturally unquestioned by the ground forces benefiting from the collaborative approach to intelligence. However, collection managers raised concerns that databases could not account for MTO tasking and collection, thereby making automated statistics impossible to compile. The DOD must evaluate these and other concerns to ensure future developments account for them appropriately. Furthermore, it must incorporate MTOs into future developments across the board, from doctrine to systems development to training.

Applying Lessons from Other Domains

Standard definitions for common tasks facilitate mission type order tasking in some of DOD's most critical domains of operations. Ground maneuver units, for example, have standardized definitions for the multitude of tactical tasks they perform. Field Manual 101-5-1, Operational Terms and Graphics, defines the task of destroy as a "tactical task to physically render an enemy force combat-ineffective unless it is reconstituted."²¹ This definition is often

compared to that of defeat, which means to “either disrupt or nullify the enemy force commander's plan and subdue his will to fight so that he is unwilling or unable to further pursue his adopted course of action and yields to the will of his opponent.”²² These conceptual definitions clearly define the intent of the given tasks, and the ISR world needs its own such vocabulary. It may not require the 15 to 20 tasks that the maneuver world often refers to, but there are surely 5 to 10 distinct roles that ISR plays which should be defined and commonly understood. The following short list is an example: over-watch, armed over-watch, target development, find, fix, track, monitor/change detect.

ISR professionals repeatedly perform distinct functions that could be defined with standardized definitions. For example, a full-motion video (FMV) analyst can spend an entire day providing over-watch of a friendly operation in an urban area, then spend the next day staring at a compound in rural Afghanistan to determine typical movement times for target development. During any over-watch mission, the FMV analyst will collaborate with the end-user much more closely, providing potentially life-saving intelligence within seconds of collection. The FMV analyst will operate quite differently during a target development mission aimed at defining the time of day when people come and go from a compound. Despite the distinct nature of over-watch versus target development missions, the ISR system currently does not task these missions differently. Furthermore, it does not train analysts to use different techniques for each type of mission even though they should not be conducted in the same manner.

This lack of common definitions for recurring roles has a detrimental effect on the system as a whole. Without common definitions of these tasks, ISR personnel cannot easily modify their collaboration procedures without significant effort. This forces many individuals across the

ISR network to exchange unnecessary communication to establish a common understanding of each mission. In addition, the lack of common definitions prevents personnel from quickly indentifying which missions need more manpower or attention. As a result, leadership at reach-back ISR centers struggle to distribute manpower and effort between certain missions that require products within hours, and others that demand reporting within seconds.

A standardized list of common ISR tasks will mitigate some risks associated with tasking ISR using mission type orders. Removing the focus on individual targets eliminates a quantifiable measurement of collection capacity. This poses a risk to the ISR system that can be overcome by introducing standard definitions of ISR tasks to help planners account for available capacity. Currently, collection managers measure capacity in terms of individual collection targets, hours of ISR coverage, or other measures of sensor coverage. This measurement focuses on the performance of machines, and not the capacity of the humans involved in the ISR process. It also reinforces the view of ISR as a machine-like, linear system. With defined ISR tasks, planners will address capacity using standardized definitions for distinct ISR roles. A common understanding of each task will help planners understand the amount and type of effort required across the ISR system.

CONCLUSION

Since the end of the Cold War, many ISR professionals have made huge improvements to many of the processes within ISR. The DOD has fielded revolutionary new sensors and the communications infrastructure required to send their data around the world in seconds. Industry has developed game-changing collaborative fusion tools. Both the DOD and national intelligence agencies have radically changed their regulations, allowing intelligence sharing between diverse analytical communities. Thousands of additional uniformed service members and contractors have been added to the intelligence community.

However, despite all these groundbreaking improvements, the DOD has retained an outdated theater ISR paradigm. Under this paradigm, the ISR network and the adversary it is tasked to counter are seen as linear systems. Doctrine and critical processes that span the entire intelligence cycle remain optimized for the Soviet threat. As a result, the ISR network is optimized, maybe managed. It is not led.

In the words of retired General Stanley McChrystal, “as we learned to build an effective network, we also learned that leading that network -- a diverse collection of organizations, personalities, and cultures -- is a daunting challenge in itself.”²³ The DOD needs a new theater ISR paradigm that recognizes the complex adaptive nature of its theater ISR network. The paradigm must capitalize on the non-linear characteristics of DOD ISR in order to counter those of our enemy. To do so, it must harmonize the efforts and initiative of its various organizations, personalities, and cultures around a common goal. Mission type orders provide a vehicle to define this common goal. This could not be more important to our success in today’s fight, or our preparation for tomorrow.

Endnotes

¹ Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms* (31 January 2011), 183.

² It is necessary to distinguish theater ISR from organic ISR. Theater ISR is that which is controlled by an overall theater commander, and has the capability and responsibility to serve multiple tactical commanders in its operations. ISR assets that are assigned to individual units, and normally work in support of those units exclusively, are considered organic. Organic ISR is generally not impacted by the theater ISR paradigm discussed in this paper.

³ Joint Publication 2-0, *Joint Intelligence*, defines the intelligence cycle as six phases of intelligence operations. The phases are as follows: planning and direction; collection; processing and exploitation; analysis and production; dissemination and integration; and evaluation and feedback (page I-7).

⁴ Field Manual 2-01.3, *Intelligence Preparation of the Battlefield/Battlespace* (Washington, DC: Headquarters, Department of the Army, 15 October 2009), pg 4-4.

⁵ Headquarters U.S. Marine Corps, *Marine Corps Planning Process*, MCDP 5-1 (Washington, DC: U.S. Marine Corps, 2010), E-3.

⁶ To simplify, the term 'collector' is used here to describe the aggregate of the sensor, the sensor platform (airborne, ground or sea-based), the intelligence interpreters who receive raw sensor output, and the analysis that generates intelligence from the collection results.

⁷ Joint Publication 2-01, *Joint and National Intelligence Support to Military Operations* (7 October 2004), 68.

⁸ Marc Sageman, *Understanding Terrorist Networks* (Philadelphia: University of Pennsylvania Press, 2004), 137.

⁹ Sageman, 151.

¹⁰ Marc Sageman, *Leaderless Jihad: Terror Networks in the Twenty-First Century* (Philadelphia: University of Pennsylvania Press, 2008), 133.

¹¹ This was widely publicized in November, 2010, when North Korean authorities revealed significant new capabilities to a former Los Alamos National Laboratories director, Siegfried Hecker, at their Yongbyon nuclear complex.

¹² Maj General Werner Widder, "Aufsragtaktik and the Innere Führung: Trademarks of German Leadership," *Military Review* (September - October 2002): 3.

¹³ Headquarters U.S. Air Force, *Theater ISR CONOPS* (Washington, DC: Headquarters U.S. Air Force, 2008), 19.

¹⁴ Although outside the purview of Joint doctrine, national agencies are also trying new approaches to overcome the same anomalies that we have discussed. Both NSA and NGA have created target specific offices that represent a blend of fusion, sensor control, and exploitation. These offices have not assumed full CRM, and these agencies still respect the collection management process that takes collection requirements from the combatant commands. But they have integrated a good portion of the function of COM along with the collectors and the fusion analysts in these offices. From a linear perspective, this seems like the consumer has become the producer, like the intelligence process has been folded around to become a self-licking ice-cream cone. Regardless, to those familiar with the output of these target offices at NSA and NGA, the results far outweigh their structural irony.

¹⁵ Joint Publication 1-02, 356.

¹⁶ Peter M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization* (New York: Doubleday/Currency, 1990), 7.

¹⁷ Murray Gell-Mann, *The Quark and the Jaguar: Adventures in the Simple and the Complex* (New York: W. H. Freeman and Company, 1994), 17.

¹⁸ Marc Sageman, *Leaderless Jihad: Terror Networks in the Twenty-First Century*, 133.

¹⁹ The earlier version of FM 100-5, published in 1976, codified the principle of Active Defense. The 1982 version of FM 100-5 introduced AirLand Battle. For more on this topic, see United States Army Training and Doctrine Command, *From Active Defense to AirLand Battle: The Development of Army Doctrine 1973 - 1982* (Washington, DC: US Government Printing Office, 1985).

²⁰ The Marine Corps republished *Warfighting* as Marine Corps Doctrinal Publication 1 in 1997.

²¹ FM 101-5-1, page 1-51.

²² FM 101-5-1, page 1-47.

²³ General Stanley A. McChrystal, "It Takes a Network," *Foreign Policy*, March/April 2011 http://www.foreignpolicy.com/articles/2011/02/22/it_takes_a_network (accessed 26 April, 2011).

Bibliography

Barabási, Albert-László. *Linked: The New Science of Networks*. New York: Perseus, 2002.

Field Manual 2-01.3, *Intelligence Preparation of the Battlefield/Battlespace*. Washington, DC: Headquarters, Department of the Army, 15 October 2009.

Gell-Mann, Murray, *The Quark and the Jaguar: Adventures in the Simple and the Complex*. New York: W. H. Freeman and Company, 1994.

Headquarters U.S. Marine Corps, *Marine Corps Planning Process*, MCDP 5-1. Washington, DC: U.S. Marine Corps, 2010.

Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 31 January 2011.

Joint Publication 2-01, *Joint and National Intelligence Support to Military Ops*, 7 October 2004.

Joint Publication 2-0, *Joint Intelligence*, 22 June 2007.

Kuhn, Thomas S., *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press, 1962.

Headquarters U.S. Marine Corps. *Marine Corps Planning Process*, MCDP 5-1. Washington, DC: U.S. Marine Corps.

Headquarters U.S. Air Force. *Theater ISR CONOPS*. Washington, DC: Headquarters U.S. Air Force, 2008.

McChrystal, Stanley A. "It Takes a Network." *Foreign Policy*, March/April 2011.

Sageman, Marc. *Leaderless Jihad: Terror Networks in the Twenty-First Century*. Philadelphia: University of Pennsylvania Press, 2008.

Sageman, Marc. *Understanding Terror Networks*. Philadelphia: University of Pennsylvania Press, 2004.

Senge, Peter M. *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York: Doubleday/Currency, 1990.

United States Army Training and Doctrine Command. *From Active Defense to AirLand Battle: The Development of Army Doctrine 1973 - 1982* (Washington, DC: US Government Printing Office, 1985)

Maj General Widder, Werner, "Auftragstaktik and the Innere Führung: Trademarks of German Leadership." *Military Review*, September - October 2002.